MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

PPH0255– PHYSICS

(Foundation in Information Technology)

17 OCTOBER 2015
2.30 P.M - 4.30 P.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with 4 questions only, excluding the cover page, physical constants and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

LIST OF PHYSICAL CONSTANTS

Acceleration due to gravity	g	$9.80\ \text{m/s}^2$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Elementary Charge	e	$1.602 \times 10^{-19}\ \text{C}$
Coulomb Constant	k	$9.0 \times 10^{9}\ \text{N m}^2.\ \text{C}^{-2}$
Permittivity of free space	ε_o	$8.85 \times 10^{-12}\ \text{C}^2\text{N}^{-1}.\text{m}^{-2}$

LIST OF FORMULA

NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2$$

$$W = Fs\cos\theta \qquad KE = \frac{1}{2}mv^2 \qquad PE_G = mgy$$

$$P = \frac{W}{t} = \frac{E}{t} = \frac{Fd}{t} = F\bar{v} \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$E = k\frac{q}{r^2}$

$\Phi = EA\cos\theta$

$\Phi_c = \frac{q_{in}}{\varepsilon_o}$

$V = \frac{U}{q_o}$

$V = \frac{kq}{r}$

$U = k\frac{q_1 q_2}{r_{12}}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = ½\,QV$

$U = ½\,CV^2$

$U = \frac{Q^2}{2C}$

$u_E = ½\,\varepsilon_o E^2$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2R$

$P = \frac{V^2}{R}$

$V = E - Ir$

STRUCTURED QUESTIONS [60 MARKS]

Instructions: Answer **ALL** questions in this section. Write your answers in the Answer Booklet.

Question 1 [15 marks]

(a) A coin with a diameter of 2.40 cm is dropped on edge onto a horizontal surface. The coin starts out with an initial angular speed of 18.0 rad/s and rolls in a straight line without slipping. If the rotation slows with an angular acceleration of magnitude 1.90 rad/s^2, how far does the coin roll before coming to rest? [5 marks]

(b) Starting from rest, a 5.00-kg block slides 2.50 m down a rough 30.0° incline. The coefficient of kinetic friction between the block and the incline is μ_k = 0.436. Determine the

(i) work done by the force of gravity, [2 marks]

(ii) work done by the friction force between block and incline, and [2 marks]

(iii) work done by the normal force. [1 mark]

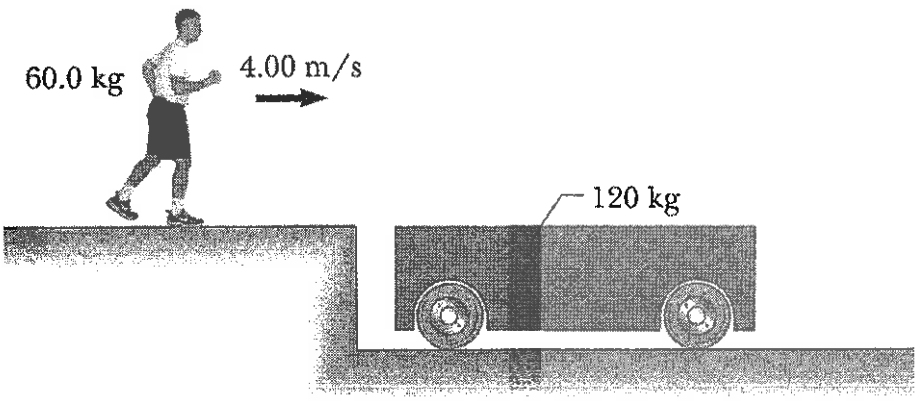

Figure 1

(c) A 60.0-kg man running at an initial speed of 4.00 m/s jumps onto a 120-kg cart initially at rest **(Figure 1).**

(i) Find the final speed of the man and cart relative to the ground. [2 marks]

(ii) Find the change in momentum of the man and the change in momentum of the cart. [2 marks]

(iii) What kind of collision is this? [1 mark]

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Question 2 [15 marks]

(a) If a current of 80.0 mA exists in a metal wire, how many electrons flow past a given cross section of the wire in 10.0 min? [2 marks]

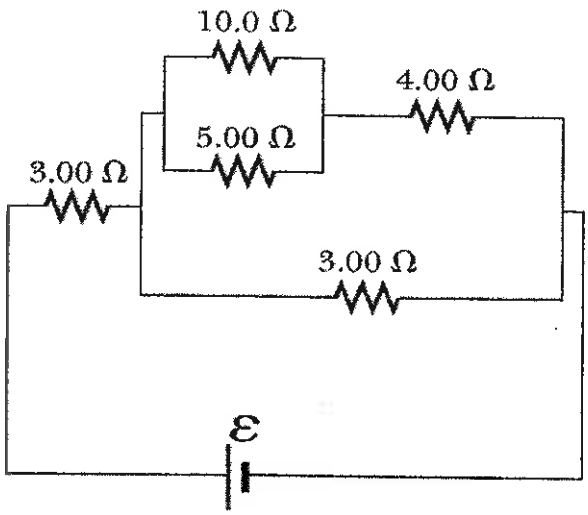

Figure 2

(b) (i) Find the equivalent resistance of the circuit in **Figure 2**. [4 marks]

(ii) If the total power supplied to the circuit is 4.00 W, find the voltage of the battery. [2 marks]

(c) (i) Sketch circuit diagrams to show the two types of bias connections of a diode to a battery and give the name for each one of them. [4 marks]

(ii) What are intrinsic and extrinsic semiconductor materials? [2 marks]

(iii) Name the process whereby impurities are added into a semiconductor material. [1 mark]

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Question 3 [15 marks]

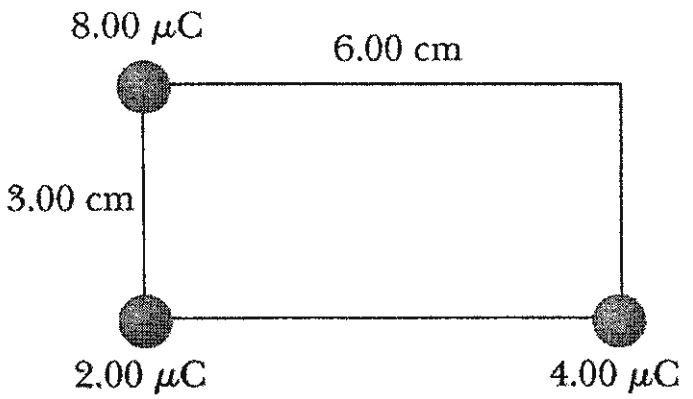

Figure 3

(a) (i) If the potential is taken to be zero at infinity, find the electric potential at the upper-right corner of the rectangle in **Figure 3**. [3 marks]

(ii) A 1.0 nC charge is brought from infinity to the upper-right corner of the rectangle. What is the potential energy of the 1.0 nC charge at that point? [2 marks]

(iii) How much work is required to bring the 1.0 nC charge from infinity to the upper-right corner? [2 marks]

(b) (i) What is a "dielectric"? [1 mark]

(ii) What is the purpose of using a dielectric? [1 mark]

(iii) A capacitor with air between its plates is charged to 100 V and then disconnected from the battery. When a piece of glass is placed between the plates, the voltage across the capacitor drops to 25 V. What is the dielectric constant of this glass? (Assume the glass completely fills the space between the plates.) [1 mark]

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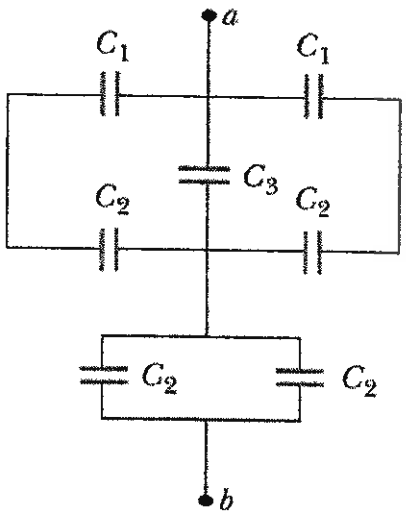

Figure 4

(iv) Find the equivalent capacitance between points a and b for the group of capacitors connected as shown in **Figure 4** if $C_1 = 5.00\ \mu F$, $C_2 = 10.0\ \mu F$, and $C_3 = 2.00\ \mu F$. [5 marks]

Question 4 [15 marks]

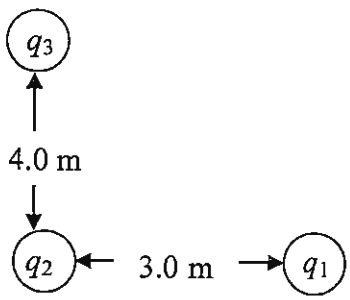

Figure 5

Figure 5 shows three charges $q_1 = +45.0\ \mu C$, $q_2 = -12.0\ \mu C$ and $q_3 = +18.0\ \mu C$. Determine

(a) the magnitude and direction of the net electrostatic force on charge q_2. [8 marks]

(b) the magnitude and direction of the net electric field at the location of the charge q_2. [3 marks]

(c) the net electric flux though a closed surface consists of all the three charges. [2 marks]

(d) the magnitude and the sign of the charge to be added so that the net electric flux through a closed surface consists of all these charges is zero. [2 marks]

End of Paper